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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
Federal Communications Commission
Washington, D.C. 20554

In Matter of Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850 - 5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications (DSRC) of Intelligent Transportation Services	ET Docket No. 98-95 RM-9096

Comments of Amtech

The Amtech Systems Division of Intermec Technologies Corporation ("Amtech") hereby submits its Comments in response to the *Notice of Proposed Rule Making* ("*NPRM*") released in this proceeding June 11, 1998. Amtech supports the allocation of spectrum proposed by the Commission. In these Comments Amtech urges the Commission to adopt regulations that accommodate both vehicle transponders that include active transmitters and those that utilize modulated backscatter techniques. Worldwide standards have already been written to facilitate both methods of communications. Both approaches offer unique benefits that can address a variety of intelligent transportation needs. Amtech also urges the Commission to specify power as 30 watts EIRP without reference to transmitter output. In addition, the agency should make clear that frequency hopping modulated backscatter systems by be employed on an unlicensed basis for DSRC applications under Section 15.247 of the current rules.

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Background

Amtech pioneered the development of intelligent transportation systems that rely on radio communications. The modulated backscatter technology that Amtech developed grew out of government-funded research at Los Alamos National Laboratories originally conducted on behalf of the Departments of Agriculture and Energy. After rights to the technology were acquired by Amtech and further developed, the technology was implemented in electronic toll and traffic management (ETTM) systems used on urban tollways and statewide turnpikes. The same technology was soon employed at airports to provide access control and to limit the time that commercial vehicles dwelled at terminal curbsides. Later, the North American railroads adopted Amtech's modulated backscatter technology as the basis for a standard used on identification tags placed on virtually every piece of rolling stock. Today, over 1.8 million trucks and automobiles in the United States and some 1.5 million rail cars use Amtech tags. Amtech tags are also employed in intermodal (air-sea-land) shipping worldwide providing for the easy identification and management of shipping containers that pass from aircraft and ocean going ships to rail cars and trucks.[1]

Modulated Backscatter Technology

Modulated backscatter makes use of fundamental radio communications principles associated with the operation of radar systems. As a radio carrier "illuminates" a target, some of the energy of the carrier is scattered (*i.e.* reflected) back toward the transmitter that generated the carrier.[2] If the target contains circuitry that can modify the reflected carrier so as to impose

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[1] See Attachment 1 for a summary of the current use of Amtech technology in the 915 and 2450 MHz bands. The 915 MHz products are primarily used in North America. The 2450 MHz products are primarily used in other regions. Some transponders are designed to respond to signals in either band.

[22] Contrary to the *NPRM* at ¶ 39, modulated backscatter systems do not commonly "sweep" across wide bandwidths. Instead a fixed frequency carrier is used to illuminate the tag. As discussed, infra, however, there is a need for unlicensed frequency hopping spread spectrum

(Continued...)

information on it (*i.e.* modulate the carrier), the reflected signal can then convey information about the target. In the technology that Amtech pioneered and that it and others now deploy, the reflected signal that has been modulated by circuitry in the tag is referred to as "modulated backscatter" for it is scattered back in the direction of the tag. The modulation can be imposed on the illuminating signal through relatively simple circuitry in a tag (also called a transponder). This circuitry effectively changes the radar cross section of the tag so that information can be conveyed. Depending on the desired range, the circuitry can be powered by extremely long life batteries or by the radio energy that is used to illuminate the tag.

Modulated backscatter transponders contrast with active transponders in that the latter contain receivers and small transmitters that generate an RF signal in response to a query received by the receiver. The signals generated by an active transponder will in virtually all cases be more powerful than the signals reflected by a modulated backscatter transponder.

Both approaches to dedicated short range communications have their advantages and both should be part of any 5.8 GHz DSRC radio service created by the Commission. Battery life of up to ten years is currently feasible for those modulated backscatter tags that do not rely on the illuminating RF signal as a power source. Frequency agility can be accomplished over a very wide range. It should, for example, be possible to have 5.8 GHz tags that would respond to signals throughout all or a portion of the proposed allocation as well as much of the 5.725 - 5.850 GHz band.[3] This agility will greatly simplify frequency management and the accommodation of existing users as well as multiple systems operated by unrelated entities. Thus, one low cost tag

(...Continued)
modulated backscatter systems. Even with such systems, the illuminating signal would remain fixed in frequency momentarily as it is employed to convey information from a tag.

[3] Dual band functionality already exists for Amtech tags that operate in the 915 MHz and 2450 MHz bands. It should be possible to develop a tag that would also include 5.8 GHz capability.

can be employed for ETTM, access control, commercial vehicle transactions such as weighing and inspections, and communications to the vehicle designed to alert the driver to road and traffic conditions.

Modulated backscatter can also be combined with signaling from the reader (*i.e.* the illuminating transmitter). Thus, it is possible to modulate the outbound signal from the reader so that it conveys information about upcoming road conditions or other information useful to those driving or occupying the vehicle. Such systems already operate in the 902 - 928 MHz band and are likely to be found in future 5.8 GHz DSRC applications.

Modulated backscatter has been incorporated into numerous standards worldwide. This was first done with systems in the United States operating in the 902 - 928 MHz band.[4] Later, standards were developed for 2.4 GHz systems, particularly for rail applications outside of North America and in the intermodal transportation area. More recently, 5.8 GHz band applications have been proposed and standards are under development, particularly in Europe, that accommodate modulated backscatter techniques.[5]

Spectrum Efficiency

The *NPRM* wrongly suggests that modulated backscatter systems are not spectrally efficient. For dedicated short range communications systems, modulated backscatter offers a very spectrally efficient approach. Contrary to the *NPRM*, modulated backscatter systems are not

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[4] *See e.g.* Association of American Railroad Standard for Automatic Equipment Identification.

[5] prEN 300 674, Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Technical characteristics and test methods for data transmission equipment operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band; pri-ETS 300 440, Radio Equipment and Systems (RES); Short range devices Technical Characteristics and test methods for radio equipment ot be used in the 1 GHz to 25 GHz frequency range.

required to "sweep" across wide bandwidths.[6] For those systems that are one-way (*i.e.* "read only"), the illuminating signal is only a carrier (*i.e.* a CW signal) of virtually no bandwidth. The bandwidth requirement is then determined by the modulation technique employed in the tag and the signaling speed associated with the modulation. The modulations utilized in the tags can be conventional modulations (*e.g.* various amplitude, frequency, or phase shifting techniques). The reflected signal for a 5.8 GHz backscatter system as received would typically be on the order of approximately -80 dBm. As such, recovery of multiple iterations of the modulated sidebands can add to the amount of received energy and facilitate the demodulation of the data that was encoded in the modulation process. Accordingly, where multiple readers are placed at one general location such as a toll plaza covering multiple lanes, planning is necessary to avoid reading adjacent lanes and desensitizing receivers at the same location. Because readers employ highly directional antennas typically canted downward, however, frequency reuse at locations not far removed from such plazas should be possible. Moreover, the low level of the reflected signal means that energy from the sidebands is not likely to pose an interference threat to other systems.

The *NPRM* posits 6 MHz wide channels for modulated backscatter systems. Such channels may, indeed, be appropriate where the DSRC system encompasses both read and write capabilities. Thus, if the reader transmits a modulated signal <u>to</u> the tag and then receives a modulated backscatter transmission from the tag, a wide bandwidth may be necessary in order to accommodate a high data rate transmission from the reader.[7] Much the same case would obtain, however, if the reader were part of an active system. Accordingly, it is reasonable to expect that

[6] *NPRM* at ¶ 39.

[7] The Caltrans standard, for example, contemplates a read - write scheme in which a broadband signal is sent to the transponder. A narrower signal is returned as modulated backscatter during the read portion of the communications exchange. See Title 21, California Code of Regulations, Chapter 16, Appendix 1.

DSRC systems will for some applications require 6 MHz wide channels as they attempt to pass data at very high rates for the extremely short period of time that a vehicle is in range.[8] In this respect, it is instructive to note that at 70 miles per hour, a vehicle travels 103 feet per second thus moving into and out of the coverage a DSRC transmitter very quickly.[9] Hence, read - write systems that are designed to convey information to vehicles necessarily must communicate at high data rates. In sum, any consideration of spectrum efficiency must take into account the communications needs of the specific application including range, vehicle speed, the amount of data to be transmitted, interference environment, feasibility of spectrum reuse, and the economics of the transponder. When all of these are considered, modulated backscatter stands out as one highly desirable approach that has already proven its usefulness in a host of applications throughout the world.

Power

The Commission proposes to allow 30 watts EIRP, but to limit transmitter output power to 750 mW.[10] The final rules should specify only EIRP. To specify the output power,

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[8] The fact that 6 MHz wide channels have been needed heretofore may also reflect the stage of development of read - write systems. While 0.08 bits/Hz would not appear efficient for conventional mobile data systems, today's mobile data systems do not operate at rates anywhere near 508,707 bits/sec. Moreover, those high speed systems that do exist are able to address needs in markets that are willing to pay for equipment that is much more complex and expensive than would be expected for DSRC applications. By contrast, DSRC systems at 5.8 GHz will be consumer products that must be introduced at prices that would appear low compared to point-to-point microwave or much of the commercial mobile data offerings of today. 5.8 GHz DSRC systems will also operate at frequencies that are nearly three times as high as today's broadband PCS, which is the highest frequency commonly available mobile data system. Accordingly, the spectrum efficiency of today's slower data rate, lower frequency systems is not necessarily the benchmark that should be used in the early implementation of 5.8 GHz DSRC.

[9] For many high speed applications, the vehicle would be in range for substantially less than one second.

[10] *NPRM*, ¶31.

particularly for licensed devices, would unnecessarily limit the design flexibility needed to meet a multitude of applications. Some of these may call for relatively long transmission lines in order to place transmitters in locations that can be reached by maintenance personnel more safely and with less disruption to traffic than might occur were the output power limitation to force the transmitter to be placed in very close proximity to the antenna.

Unlicensed Operation

The *NPRM* noted that Amtech urged the Commission to consider provisions for unlicensed operation of certain DSRC systems.[11] These systems would greatly benefit consumers who could use them for access control and commercial transactions. It would also be possible to use readers on vehicles to interrogate transponders at intersections or other locations. Accordingly, unlicensed use should be a part of the DSRC scheme whether or not it is authorized within the 5.850 - 5.925 GHz allocation.

But for the manner in which the Commission staff currently interprets the definition of the term "frequency hopping spread spectrum system," the provisions of Section 15.247 of the Rules would now accommodate unlicensed DSRC systems in the 5.725 - 5.825 GHz band.[12] If this interpretation were changed, the existing unlicensed spread spectrum bands could accommodate many DSRC applications and thereby largely obviate the need for unlicensed

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[11] *NPRM*, ¶42.

[12] Section 2.1 of the Rules defines "frequency hopping systems" as [a] spread spectrum system in which the carrier is modulated with the coded information in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. The wide RF bandwidth needed by such a system is not required by spreading of the RF energy about the carrier but rather to accommodate the range of frequencies to which the carrier frequency can hop. The test of a frequency hopping system is that the near term distribution of hops appears random, the long term distribution appears evenly distributed over the hop set, and sequential hops are randomly distributed in both direction and magnitude of change in the hop set."

DSRC operations within the 5.850 - 5.925 MHz band.[13] Because of the ability of modulated backscatter tags to function over wide frequency spans, the same tag could be employed for unlicensed applications in the 5.725 - 5.825 GHz band and for licensed applications in the 5.850 - 5.925 GHz band.[14] Absent such a change in interpretation, the Commission should provide for unlicensed DSRC operations in a portion of the 5.850 - 5.925 GHz band.

As explained to Amtech, the problem with the current rules is that the definition says that such a frequency hopping spread spectrum system has the carrier modulated with coded information "in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier." For reasons that are not apparent, separating the circuitry that generates the carrier (*i.e.* the illuminating signal) by a few feet from the circuitry that imposes the modulation (*i.e.* the tag or transponder) has been deemed "unconventional." This interpretation that the definition of spread spectrum system precludes a read-only modulated backscatter system should be revised to make clear that placing the modulator in the transponder and then illuminating the transponder from a few feet away falls well within scope of conventional.[15]

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[13] At the same time, the Commission should make clear that Section 15.247 of the Rules allows DSRC applications to be conducted on a frequency hopping spread spectrum basis in the 915 and 2450 MHz bands. Note, however that the field strengths that would be produced under Section 15.245 and Section 15.249 would not support unlicensed DSRC that would employ modulated backscatter techniques in the 5.8 GHz band.

[14] At least for modulated backscatter systems, the proximity of these bands to the European 5.8 GHz DSRC band would allow a single tag or transponder to be used in both the United States and Europe for many applications.

[15] The history of the development of the spread spectrum rules makes clear that the term "conventional" was employed to distinguish frequency hopping spread spectrum modulation approaches from direct sequence spread spectrum in which a spreading code is added to a signal that has already been modulated in a "conventional" way. The adjective "conventional" was first proposed in the Further Notice of Inquiry and Notice of Proposed Rulemaking in Gen. Docket No. 81-413, 98 FCC 2d 380, 397 (1984). It was adopted in the First Report and Order in Gen. Docket No. 81-413, 101 FCC 2d 419, 430 (1985).

Such a change in interpretation would require no rule change nor would it create the potential for interference that is any greater than that now associated with unlicensed spread spectrum systems. Indeed, given the low sideband energy of modulated backscatter systems, the narrow higher powered carrier should pose less of an interference threat than would the signal of a frequency hopping signal that modulated the signal transmitted from the reader or a modulated signal transmitted from the tag with a greater depth of modulation.

Amtech suspects that some of the reluctance to allow frequency hopping spread spectrum modulated systems stems from confusion over the application of the Section 15.245 field disturbance rules. Certain read-only RF identification systems that simply provide a number identifying a tag bear a functional resemble to systems that may have been authorized under Section 15.245. Nevertheless, nothing in the definition of "field disturbance sensor" or "frequency hopping spread spectrum system" should preclude use of the latter valuable technique for DSRC systems.[16] In fact, the Commission has authorized frequency hopping radio frequency identification systems under Section 15.247 that use modulated backscatter for communicating from the transponder to the reader, but the systems approved to date also have a "write" function in which a modulated signal is transmitted to the transponder from the reader. This latter type of system is clearly in the public interest and well within the definition of "frequency hopping spread spectrum system." The read-only counterpart should also be found to be in the public interest and within the definition for it, too, could serve many valuable uses and would pose an even lower interference threat that read-write systems.

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[16] Section 15.3 of the Rules defines a field disturbance sensor as "[a] device that establishes a radio frequency field in its vicinity and detects changes in that field resulting from the movement of persons or objects within its range."

Conclusion

This rule making marks another important milestone on the road leading toward the development of intelligent transportation systems in which information highways supplement those made of asphalt and concrete. In the first report and order to flow from this *NPRM*, Amtech urges the Commission to establish the allocation, to recognize the need for rules that facilitate a variety of techniques including modulated backscatter, and to clarify that the existing Part 15 spread spectrum rules allow for the use of frequency hopping modulated backscatter for DSRC applications.

Respectfully submitted,

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September 14, 1998

Attachment 1

Amtech Technology Solutions for Road and Railroad Applications

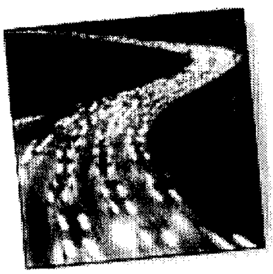
Attachment 1

Amtech Solutions for Road and Railroad Applications

Intermec
Amtech Systems Division

Markets Served

Electronic Toll and Traffic Management



Our wireless data technology for electronic toll and traffic management is the foundation for today's intelligent transportation systems. In fact, we've provided solutions and equipment, including complete turnkey systems, for more than 32 significant electronic toll and traffic management installations in 12 countries. More than 2 million Amtech tags have been sold for electronic toll and traffic management use alone.

Amtech Systems Division introduced the first wireless tag/reader system in the United States for the electronic toll and traffic management industry. With that kind of jump on the competition, we made a commitment to always stay on the leading edge of technology. That way we're sure our products are the most reliable and the most innovative. And because Amtech offers compatible products, you can plan your system using a mix of the best read-only and read/write technology for your needs today.

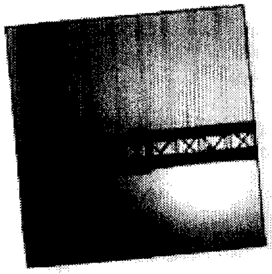
Applications

- Automatic vehicle identification (AVI)
- Electronic toll collection (ETC)
- Electronic toll and traffic management (ETTM)

Benefits

- Increases patron convenience and safety with nonstop payment
- Improves traffic flow/reduces commute times
- Reduces operating costs for toll operators
- Reduces need for new roads
- Reduces traffic congestion
- Provides proven reliability and unparalleled accuracy
- Reduces congestion and pollution

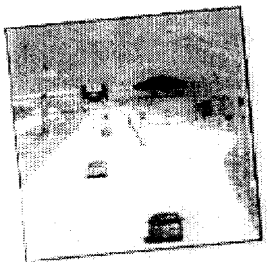
Customer Highlights



Ponte Rio-Niterói, Rio de Janeiro

Crossing Into Paradise

Amtech paves the way with Brazil's first electronic toll collection system. Amtech's growing reach and influence is reflected in the smooth efficiency of the Rio-Niterói Bridge installation. A major hub in the road system of southeastern Brazil, more than 80,000 daily commuters traverse the 8-mile causeway each day.



All 10 turnpikes, Oklahoma

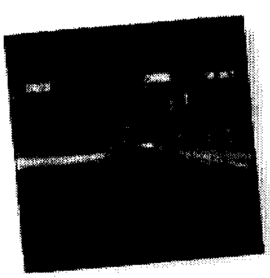
With 407,000 PIKEPASS Tags in Operation, Oklahoma is OK

With 278 toll lanes, totaling more than 560 miles, the state of Oklahoma can claim the first and largest open-highway electronic toll collection system in the world. And the numbers keep adding up. The Oklahoma Turnpike Authority has purchased its 407,000th Amtech tag. And that's OK with Oklahoma PIKEPASS patrons who can drive at continuous highway speeds on all 10 turnpikes throughout the state.

Florida Department of Transportation

Sunshine State to Install Amtech's ETC Equipment for Statewide SunPass System

In January 1997, the Florida Department of Transportation awarded Amtech the largest ETC contract in its history. The contract calls for Amtech to provide its read/write Intellitag® product line on approximately 460 lanes throughout the state of Florida. More than 327,000 SunPass vehicle tags will be distributed, including an advanced Intellitag with display, keypad, indicator lights and audio alert. Installation will begin in late 1997 and is scheduled to be completed in 2000.



Georgia 400, Atlanta

The Day the Lights Came On in Georgia

Originally, Amtech provided a automatic vehicle identification system for 18 lanes of the Georgia route 400 extension in Atlanta. Vehicles equipped with Amtech's ETC tag zipped through four designated express, or Cruise Card, lanes without slowing down. Studies indicated that 1,800 vehicles per hour could be processed through the Georgia 400 ETC express lanes as compared to 350 vehicles per hour in the traditional manned toll lanes.

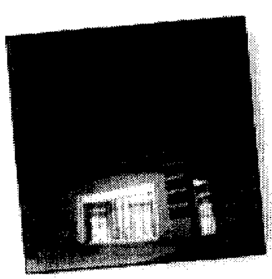
Recently, the Georgia 400 authority took full advantage of Amtech's fully compatible product line. They are enhancing the successful Georgia 400 installation by adding an Intellitag® system with audiovisual indicators. The new read/write tag features an instant response light and is programmable for future features.

But most importantly, the new Intellitag system is completely compatible with the existing read-only system. This flexibility allows Georgia 400 to operate with a mixed population of tags. Over time, Georgia will be able to use the features of the more advanced Intellitag platform, while providing seamless service to toll patrons. This process will preclude a massive recall of existing tags, thus avoiding a huge and unnecessary cost and inconvenience to motorists.

Kansas Turnpike Authority

104,000 Tags, 236 Miles of Highway, 73 Electronic Reader Lanes, 27 Toll Plazas, 1 System--Intellitag®

Amtech's extensive installation on the Kansas Turnpike is a good example of the capabilities a read/write system can offer. Amtech's Intellitag product stores location and time as a vehicle enters the toll highway. The patron's account balance can be quickly adjusted as the vehicle passes through the exit plaza. And because the Kansas Turnpike's read/write tag can also emulate the ISO read-only standard, these tags are also compatible with the statewide Oklahoma system.



Transtar

Houston TranStar Eases Traffic in Lone Star State

In 1993, Amtech installed the first combined electronic toll and traffic management (ETTM) system in the world. The system was installed to monitor congestion on all major roads in the Greater Houston/Harris County area for the Texas Department of Transportation, the Metropolitan Transit Authority of Harris County, the City of Houston and Harris County. As the traffic management part of this system, Amtech tags on vehicles serve as intelligent traffic "probes." These probes relay information regarding traffic flow and travel times on highways to a facility named Houston Transtar - a space-age traffic management center for all Houston emergency services except police

911. The ETTM system provides:

- Minute-by-minute information for traffic diversion messages displayed on variable message signs and a site on the Internet: http://traffic.tamu.edu/traffic.html
- Traffic information via local radio stations 24 hours a day
- Enhanced traffic information by monitoring vehicles electronically tagged for other applications

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Key Products and Systems

Read-Only System

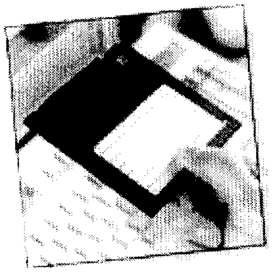
Amtech's standard read-only system provides an incredibly reliable operational link between tagged vehicles and your information management systems

- Operates in both 915 MHz and 2450 MHz bands
- ISO, AAR, ATA and ANSI compatible tags
- Error-correcting protocol
- Selectable power supply includes 110/220 VAC; optional harsh environment AC and DC power available
- Identification data filtering set to user-programmable criteria
- Output control for gates and signal lights
- Radio frequency module compatibility

Read/Write System--Intellitag®

Intellitag is infinitely more than just a tag--it's a comprehensive read/write system for identifying, monitoring, and managing anything that moves on wheels.

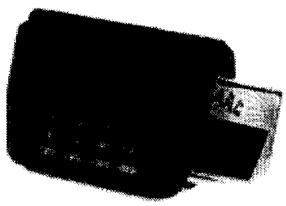
- Protocols for direct and multiple access and ISO, AAR, ATA and ANSI provide total compatibility
- Partitioned memory for multiple applications, expansion
- Unmatched security
- Operates in 915 MHz band



Software

Amtech offers complete lane and plaza integration software, as well as software solutions for the system host.

New Products and Technologies



Smart Card/Tag Technology

With Amtech's prototype smart card/tag technology a smart card can be inserted into the tag so that payment can be made on a real-time basis. The technology has the following features:

- Radio frequency programmable
- High-speed read/write capability
- Audio indicator with visual alphanumeric display
- Multiple frequency bands

Key Customers

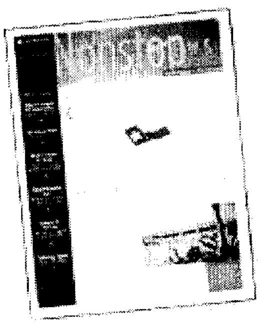
Argentina		
Autopista del Oeste, Buenos Aires	43 lanes	10,000 tags
Autopista 25 de Mayo, Buenos Aires and Autopista Perito Moreno, Buenos Aires	8 lanes	31,500 tags
Autopista de la Plata, Buenos Aires	14 lanes	10,000 tags
Autopista Ezeiza-Cañuelas Sociedad Anónima, Buenos Aires	6 lanes	20,000 tags
Brazil		
Concessionario Rio-Teresópolis, Rio de Janeiro	4 lanes	5,000 tags
Linha Amerela, S.A., Rio de Janeiro	4 lanes	10,000 tags
Ponte Rio-Niterói and Via Lagos, Rio de Janeiro	8 lanes	60,000 tags
Rodavia Presidente Dutrá, Rio de Janeiro	8 lanes	TBD
Canada		
A. Murray MacKay and Angus L. Macdonald Bridges, Halifax-Dartmouth, Nova Scotia	24 lanes	25,000 tags
Highway 104 of the Trans Canada Highway, Nova Scotia	6 lanes	7,000 tags
Saint John Harbour Bridge Authority, New Brunswick	10 lanes	2,650 tags

France		
Autoroutes Esterel Cote d'Azur (ESCOTA), Antibes	70 lanes	90,000 tags
Compagnie Financiere et Industrielle des Autoroutes (COFIROUTE), Tours	25 lanes	10,000 tags
Société des Autoroutes Paris Rhin Rhone (SAPRR), Villefranche	9 lanes	5,500 tags
Hong Kong		
Aberdeen, Cross Harbour, Lion Rock, Eastern, and Western Harbour Crossing Tunnels	22 lanes	100,000 tags
Korea, South		
Kwachun	2 lanes	3,000 tags
Mexico		
Countrywide IAVE system, including: • Caminos y Puentes Federales de Ingresos y Servicos Conexos (CAPUFE) • State of Sonora, State of Guanajuato and State of Chihuahua • Ingenieros Civiles Asociados, Guadalajara • Grupo Mexicano de Desarollo, Acapulco, and Veracruz	204 lanes	40,000 tags
Puerto Rico		
Puente Teodoro Moscoso, San Juan	8 lanes	10,000 tags
Spain		
Autopistas, Barcelona	70 lanes	200,000 tags
Thailand		
First Stage Expressway, Bangkok	46 lanes	50,000 tags
Ramindra Expressway, Bangkok	16 lanes	50,000 tags
United Kingdom		
Severn River Bridge, Bristol	18 lanes	20,000 tags
United States		
All 10 turnpikes, Oklahoma	278 lanes	407,000 tags
Crescent City Connection, New Orleans	12 lanes	94,432 tags
North Texas Tollway Authority, Dallas	86 lanes	239,859 tags
Florida Department of Transportation Due to be completed in 2000.	460 lanes	327,000 tags
Georgia 400, Atlanta Traffic management system, 77 lanes.	95 lanes	112,500 tags
Hardy Toll Road, Houston Ship Channel Bridge, Sam Houston Tollway, Houston	222 lanes	335,000 tags
Kansas Turnpike Authority	73 lanes	104,000 tags
Lake Ponchartrain Causeway, New Orleans	7 lanes	27,000 tags
Lee County Bridge, Florida	34 lanes	152,160 tags
Metropolitan Transportation Authority Bridges and	257 lanes	n/a

Tunnels, New York City Scheduled for completion in 1998		
Pharr-Reynosa International Bridge, Pharr, Texas	4 lanes	250 tags
Texas Department of Transportation, San Antonio	193 lanes	78,000 tags
Transtar U.S. Highways 59 and 290, Interstates 10, 45 and 610, Houston	360 lanes	15,000 tags

Download Literature

- ***Nonstop News newsletter, 1998***



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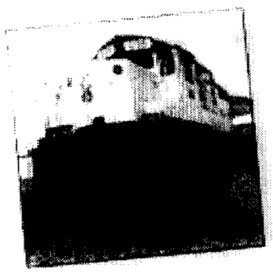
Amtech Systems Division

Markets Served

Rail and Intermodal



Tracking billions of dollars of equipment and cargo is crucial for good customer service and efficient rail and intermodal operations. That's one reason the North American rail industry adopted a mandatory standard based on Amtech Systems Division's technology that requires radio frequency tags on every piece of rail equipment in interchange service in North America. More than 97 percent of all railcars in interchange service have been tagged. Railroads can now manage cars and locomotives nationwide.

Amtech's wireless technology electronically identifies and monitors rail and intermodal equipment. This allows rail, intermodal, marine, and trucking companies to track and monitor equipment more effectively, which increases equipment use and reduces re-handles, dwell time, and overhead. Amtech systems are also used in automatic train positioning systems.

Applications

Automatic Equipment Identification

- Railcar and equipment tracking
- Yard management/equipment inventory
- Gate control access
- Fuel terminal authorization
- Automatic weigh-in-motion
- Chassis management
- Train positioning

Automatic Equipment Monitoring

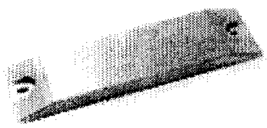
- Recording vehicle impact
- Assessing locomotive, generator or refrigerator fuel levels
- Monitoring cushioning devices
- Detecting moisture and leaks
- Detecting door openings
- Monitoring temperature

Benefits

- Improves asset tracking, management and use
- Reduces operating costs

- Provides real-time reporting
- Eliminates costly human errors

Key Products and Systems

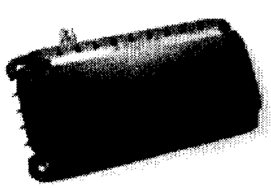


Transportation Tag and Reader System

With more than 3.7 million tags and 6,000 reader sites, Amtech's transportation tag and reader system is the automatic equipment identification (AEI) workhorse for the rail industry. Together, Amtech's transportation tag and reader system provide an easy and inexpensive way to improve productivity and reduce costs. Simply mount the transportation tag on trailers, chassis, railcars, containers, locomotives, and truck cabs. Then install Amtech readers at strategic points, such as railroad junction points and yards, gates, fuel lanes, and maintenance facilities. As tagged equipment passes a reader, the transportation tag identifies the equipment and the reader relays the time, date, or other programmed information to a host computer. The tag is designed for use in applications requiring long-range operation or exposed to harsh environmental conditions.

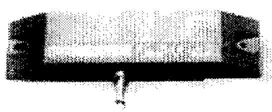
Chassis Management System (Transportation Tag and SmartPass® Reader)

By combining Amtech's transportation tag with Amtech's SmartPass® integrated reader system, intermodal and trucking companies can track chassis, containers and other equipment as soon as it enters the terminal gates. For example, the serial number, time, and date of transaction is sent to the host computer the moment the tagged equipment passes a reader. Additional information can be programmed into the tag to provide key data such as the kind of container on the chassis, the owner of the chassis, the size and weight of the shipment, and even the bill of lading. The Amtech system also helps ensure timeliness and accuracy and improve scheduling. Hands-free and wireless, these systems improve equipment and inventory accuracy, eliminate paperwork and increase employee productivity by automating the equipment tracking procedures at the terminal. The transportation tag operates in both 915 and 2450 MHz bands.



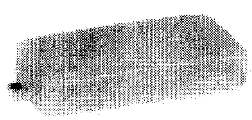
Dynicom®

Amtech's high-speed read/write Dynicom system is used for automatic locomotive management, mass transit positioning, passenger information systems, freight tracking, and transport monitoring. Dynicom's high-speed data exchange provides information to maximize use of existing assets, which dramatically reduces operating costs. Dynicom has been selected by the Union Internationale des Chemins de fer (UIC) as the standard for a unified European automatic vehicle identification system. In compliance with the UIC standard, Dynicom has an open communication protocol and exceeds UIC specifications by performing at speeds above 240 mph (400 kmh).



Dynamic Tag

Now an investment in AEI can mean more than reading a railcar or locomotive's identification, it can also give you advance monitoring information. With Amtech's Dynamic Tags, accurate fuel levels, cumulative kilowatt hours, water and oil pressure, temperature and other critical information is in your hands before the train is in the yard. Tag data can be programmed to conform to the Association of American Railroads' standard for impact recorders, refrigerated vehicles, and locomotives requiring two frames of data.



Absolute Positioning Reference System

Amtech's high-speed absolute positioning reference system (APRS) helps railroads increase track utilization by monitoring various trains at vastly different speeds, and improve safety by eliminating line collisions and overspeed derailments and accidents. In addition to providing train positioning, the system is also capable of informing the host computer of transient conditions such as temporary speed restrictions and the status of trackside control systems. Amtech's APRS includes tags, or transponders, that are placed between the running rails on the trackbed, and a reader that is mounted beneath the train. The APRS can read trains at speeds up to 310 mph (500 kmh).

Key Customers

Australia
National Rail Corporation Limited Queensland Railway
Austria
Krems Chemie
Belgium
Brussels Metro
Canada
Canadian National Railroad Canadian Pacific Railway Company
China

Ministry of Railway

France

Compagnie Nouvelle de Conteneurs
Norsider
SCAC Delmas Vieljeux
Société Nationale des Chemins de fer
Sollac

Germany

Hamburg Metro
Kombiverkher

Hong Kong

Mass Transit Railway Corporation

Italy

Ferrovie Dello Stato

Japan

Shikoku Japan Railway Company
Teito Rapid Transit Authority

Poland

Polskie Koleje Panstwawe

Singapore

Port of Singapore Authority

Slovenia

Hydro Aluminium

South Africa

Spoornet

Spain

Port of Santander

Semat

Sweden/Norway

Malmbanan Ore Line

Switzerland

Schweizerische Bundesbahnen

Taiwan

Evergreen

United Kingdom

British Rail
Combined Transport Limited
Eurotunnel
London Underground
National Power

United States

APL Limited
Atlanta MARTA (station annunciation)
Burlington Northern Santa Fe Railroad
Consolidated Rail Corporation
CSX Transportation
Jacksonville Airport Transit System
Illinois Central Railroad
Kansas City Southern Railway Company
Matson Navigation Company, Inc
Newark Airport Transit System
Norfolk Southern Corporation
Port of Tacoma
Union Pacific Railroad
Wisconsin Central Railroad

For more information call (800) 923-4824.
Outside the United States call (214) 360-9436.